Data Structures

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What is a data structure

- Structures that hold data (amazing)
- Data structures you know:
  - Lists, sets, dictionaries
  - These are all built in
- What about other data structures?
  - We’re going to talk about other data structures
  - You can implement these as classes in Python
    - You can also import a good number of these

Why do we need data structures?

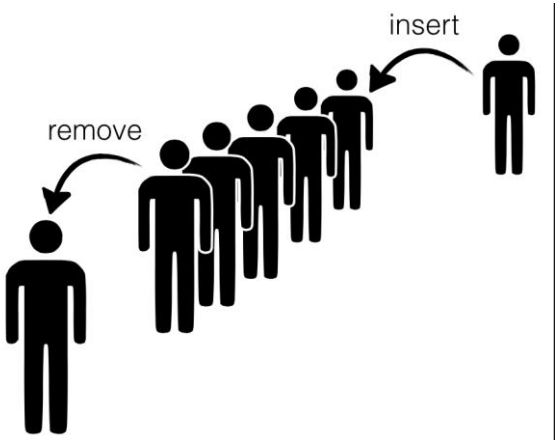
- Organization
- Efficiency
  - Time
  - Space
  - Every data structure has its own benefits

Queues

We british yo

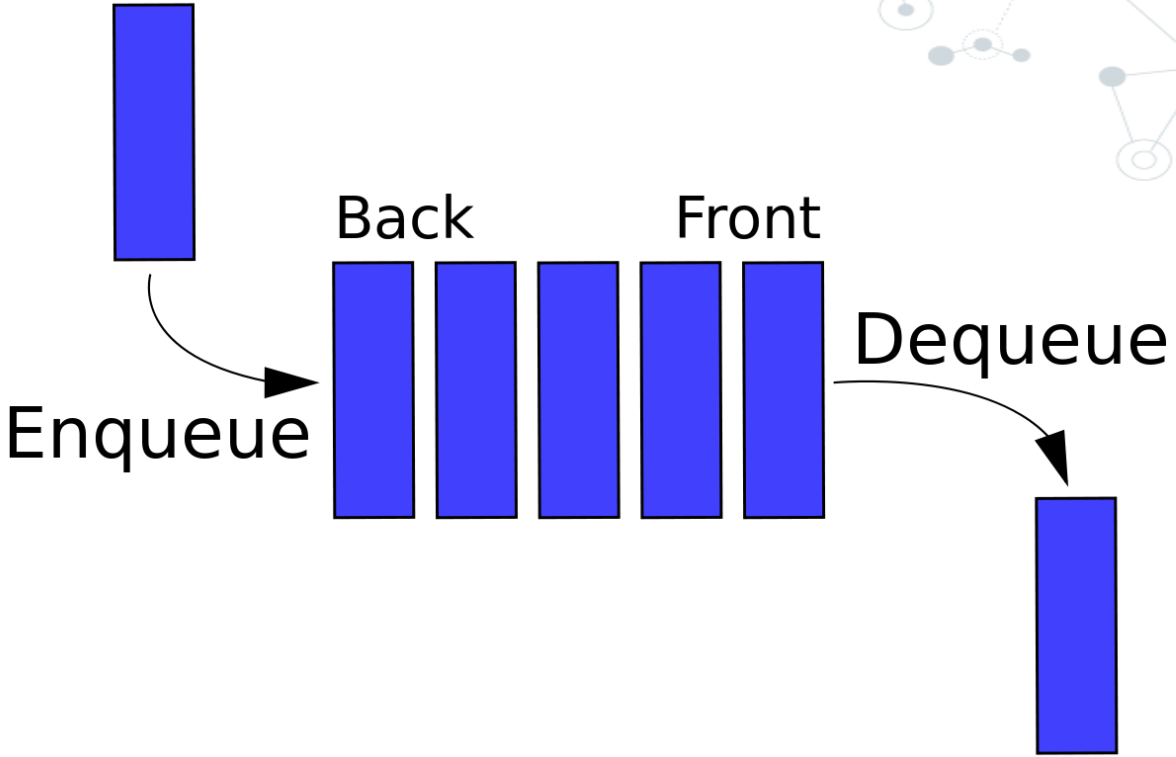
What it is

- You know how the British call a line a queue? Yeah, that.
- First in first out (FIFO)
- You could make this with a list
  - Or using OOP



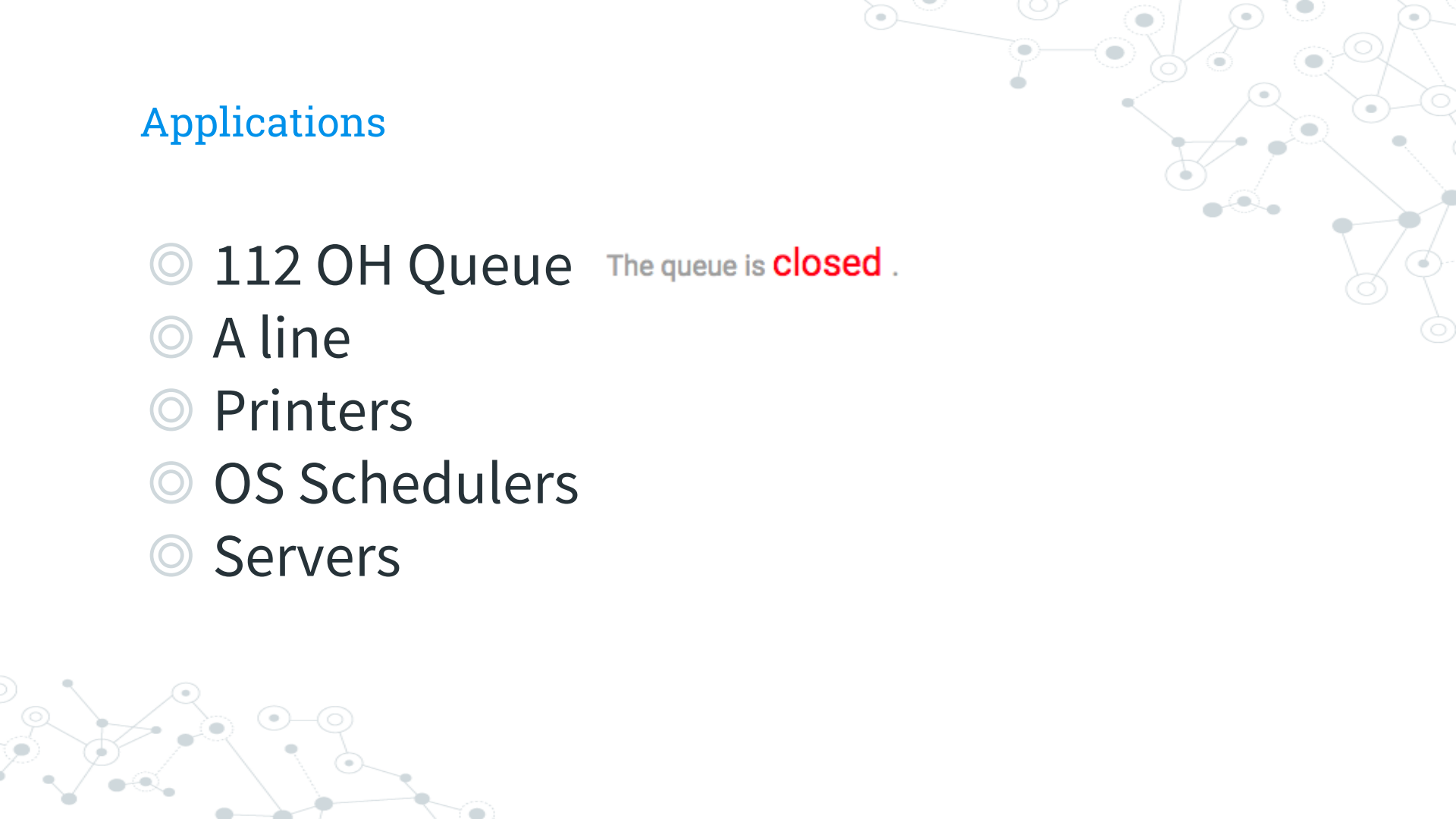
Classic methods

- Enqueue
- Dequeue



Applications

- 112 OH Queue
- A line
- Printers
- OS Schedulers
- Servers



Stacks

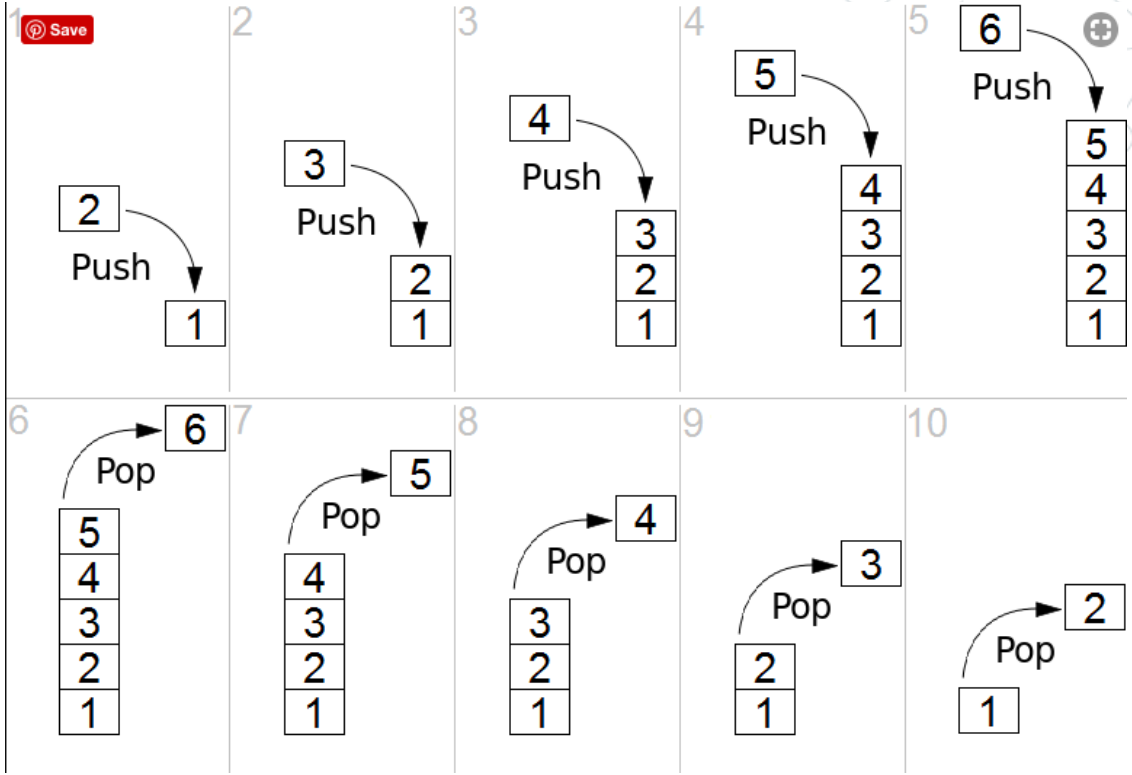
Of dinner plates

What it is

- Last in first out (LIFO)
- A stack of plates: we always use the one on top first
- You could also make this using a list

Classic methods

- Push
- Pop
- Peek



Applications

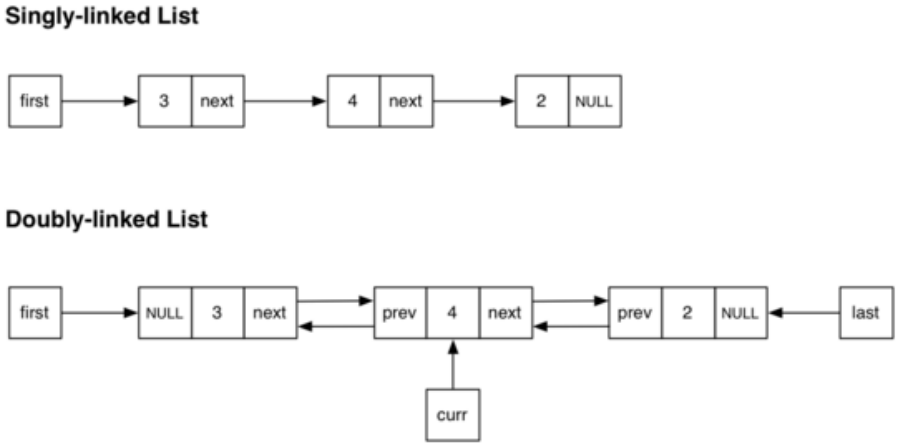
- Calculators
- undo/redo in word
- Call stack - computers (stack overflow :D)
- Reversing data
- Decimal to binary conversion

Linked Lists

Lists that are linked (jk not always)

What it is

- Make this with OOP
- List of arbitrary data
- Keep track of what's next
- Maybe what's before it



Classic methods

- Next
- Find
- Remove
  - @ cracking the coding interview
  - This is constant time and it’s cool af
- Insert
  - Constant time!

Applications

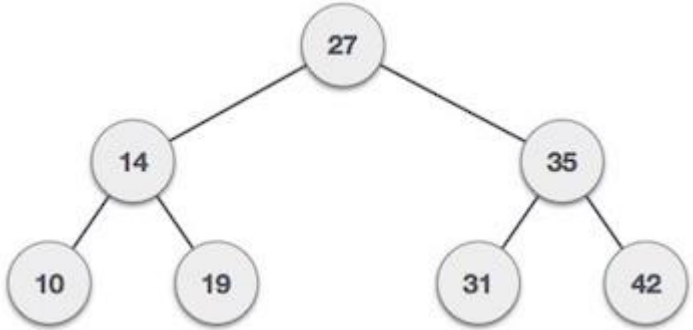
- Memory management on our computers
- Hash tables
- Photo viewers
  - Things that have order but aren’t related

Binary Trees

Bst bst bst bst

What it is

- If you traverse the tree in order, it gives you a sorted list



Classic methods

- Search
  - O(logn) time awesome
- Add
  - Also log time
- Remove
  - Also log time I guess

Applications

- Binary search (woah) (Binary search tree)
- Heaps, AVL trees, lots of other trees
- Data compression
- Evaluating expressions (like math)
- Sometimes use to implement sets and dictionaries

Heaps

Of fun

What it is

- A type of tree
- Guarantees an ordering on me vs my children
  - You can define ordering any way you want
- Max Heap vs min heap
- Leftist side bias ordering

Classic methods

- Add
- Remove
- Find min or max
  - Constant time

Applications

- Heapsort
- Cool graph search things
  - Come to our graph theory lecture shameless plug
- Priority queues
  - Omg is this the next data structure we're talking about???

Priority Queues

Queues but priorities

What it is

- A heap that is sorted by priority
- It’s like a queue, except we care about the priority instead of when it came in

Classic methods

- Get
- Size
- Empty
- Full
- Add

Applications

- Prioritizing tasks
  - Computers
  - Even in your head!
    - Node value: the task
    - Node priority: how important it is to complete
- To Do lists (for your homework, or maybe the operating system)
- More data compression techniques

Yay the end

Have fun :D